FILICES WILSONIANAE

H. CHRIST

(WITH TWO FIGURES)

[The ferns collected by Mr. E. H. WILSON from 1907–1908 in Hupeh and Szech'uan, during the Arnold Arboretum expedition to western China, were placed in the hands of Dr. H. CHRIST of Basel. His report upon them is found in the following paper.—C. S. SARGENT, *Arnold Arboretum.*]

Province of Hupeh[1]

WOODSIA POLYSTICHOIDES Eat.—Fang Hsien; cliffs, 4000–6000 ft.; August 1907; no. 2602.—J.

DRYOPTERIS DECURSIVE-PINNATA (*Polypodium* Van Hall) O. Ktze.—Patung Hsien; woodlands, 3000–4000 ft.; May 1907; no. 2599.—J.

DRYOPTERIS ROBERTIANA (*Polypodium* Hoffm.) C. Chr. Ind.—Fang Hsien; cliffs, 4000–6000 ft.; August 1907; no. 2627.—E.A.

DRYOPTERIS HENDERSONI (*Lastrea* Bedd.) C. Chr. Ind. (*Aspidium spectabile* Wall.).—Changyang Hsien; woodlands, 3000–4000 ft.; May 1907; no. 2630.—H.

POLYSTICHUM SPECIOSUM (*Aspidium* Don) J. Sm. (*Aspidium affine* Wall.).—Patung Hsien; woods, 1800 ft.; April 1907; no. 2626.—H.

*POLYSTICHUM MUPINENSE (*Aspidium* Franchet) Bedd.—Fang Hsien; cliffs, 4000–6000 ft.; September 1907; no. 2601.

*POLYSTICHUM ICHANGENSE Christ.—Fang Hsien; cliffs, 4000–5000 ft.; August 1907; no. 2609.

POLYSTICHUM ACULEATUM (L.) Schott.—Forma tenera, profunde dentata, caeterum typica.—Hsing-shan Hsien; woods, 4000–6000 ft.; August 1907; no. 2611.—H.J.E.A.

*POLYSTICHUM DEVERSUM Christ, n. sp.—Fang Hsien; woodland, 5000–6000 ft.; August 1907; no. 2625.

[1] I have indicated with an H the species found in India and chiefly on the southern slope of the Himalayan Chain; those found in Japan with a J; those found in Europe with an E; and those found in America with an A. I have indicated with an asterisk (*) the species peculiar to Hupeh and western Szech'uan.

*POLYSTICHUM MOLLICULUM Christ, n. sp.—Fang Hsien; 8000 ft.; June 27, 1907; no. 2657.

*POLYSTICHUM LEUCOCHLAMYS Christ, n. sp.—Fang Hsien; woods, rocks, 5000–6000 ft.; November 1907; no. 2600.

*POLYSTICHUM LOBATUM (*Aspidium* Hds.) Prsl. var. CHINENSE Christ Nuov. Giorn. Bot. Ital. **4**:92. 1897, et Bull. Soc. Bot. France **5**:1905.—Hsing-shan Hsien; 4000–6000 ft.; July 1907; no. 2612.

POLYSTICHUM DELTODON (*Aspidium* Baker) Diels.—Fang Hsien; woods, 5000–6000 ft.; November 1907; no. 2620.

CYRTOMIUM FALCATUM (*Polypodium* L. fil.) Prsl. var. MUTICUM Christ Notulae System. Mus. Paris no. 25. 1909.—Hsing-shan Hsien; woods, 4000–5000 ft.; August 1907; no. 2628.

ODONTOSORIA CHINENSIS (*Trichomanes* L.) J. Sm.—Ichang; roadsides and sunny places generally, 1000–1400 ft.; July 1907; no. 2663.—H.J.

ASPLENIUM PROLONGATUM Hook.—Fang Hsien; rocks, 1000–1500 ft.; August 1907; no. 2655.—H.J.

ASPLENIUM TRICHOMANES L.—Fang Hsien; cliffs, 4000–7000 ft.; August 1907; no. 2659.—H.J.E.A.

BLECHNUM EBURNEUM Christ.—Patung Hsien; moist cliffs, 2000 ft.; July 1907; no. 2678.

CONIOGRAMME FRAXINEA (*Diplazium* Don) Diels.—Fang Hsien; woodland; November 1907; no. 2679.—H.J.

ADIANTUM PEDATUM L.—Fang Hsien; woods, 3000–6000 ft.; July 1907; no. 2672.—H.J.A.

*ADIANTUM ARISTATUM Christ, n. sp.—Fang Hsien; rocks, 3000–4000 ft.; November 1907; no. 2674.

PTERIDIUM AQUILINUM (L.) Kuhn.—Ichang; abundant (starch is obtained from the rhizome), 1000–10,000 ft.; May 1907; no. 2682.—H.J.E.A.

PTERIS LONGIFOLIA L.—Ichang; dry rocks, 1000–3000 ft.; April 1907; no. 2665.—H.J.E.A.

PTERIS CRETICA L. var. SUBSERRULATA Christ, n. var.—Fang Hsien; shady rocks; July 1907; no. 2670.

POLYPODIUM SUBAMOENUM Clarke.—Fang Hsien; 4000–6000 ft.; August 1907; no. 2648.—H.

POLYPODIUM CHINENSE Metten.—Fang Hsien; cliffs, rocks, 3000–6000 ft.; August 1907; no. 2640.

POLYPODIUM EXCAVATUM Bory.—Hsing-shan Hsien; rocks, 2000–5000 ft.; August 1907; no. 2635.—H.J.

*POLYPODIUM LINEARE Thunberg.—Hsing-shan Hsien; rocks, 2000–5000 ft.; August 1907; no. 2635 bis.—H.J.

POLYPODIUM CONTORTUM Christ (*P. lineare* Thnbg. var. *contortum* Christ Nuov. Giorn. Bot. Ital. **4**:1. Jan. 1897–1898).—Fang Hsien; rocks and trees, 4000–6000 ft.; August 1907; no. 2636.

POLYPODIUM CLATHRATUM Clarke.—Fang Hsien; cliffs, 3000–6000 ft.; August 1907; no. 2642.—H.

POLYPODIUM DRYMOGLOSSOIDES Baker.—Fang Hsien; on trees and rocks, 3000–5000 ft.; July 1907; no. 2647.

DRYMARIA FORTUNEI (*Polypodium* Ktze.) J. Sm.—Ichang; abundant on rocks and trees, 1000–3000 ft.; April 1907; no. 2646.

CYCLOPHORUS CALVATUS (*Polypodium* Baker) C. Chr. Ind. 198. —Fang Hsien; cliffs, 3000–6000 ft.; August 1907; no. 2641.

CYCLOPHORUS DRAKEANUS (*Polypodium* Franchet) C. Chr. Ind. 198.—Fang Hsien; cliffs, 1000–6000 ft.; no. 2627.

LOXOGRAMMA INVOLUTA (*Grammitis* Don) Presl. (*Polypodium scolopendrinum* C. Chr. Ind. 562).—Hsing-shan Hsien; 2000–5000 ft.; October 1907; no. 2661.—H.

GLEICHENIA LINEARIS Burm.—Ichang; open country, forming jungles, 1000–3000 ft.; no. 2677.—H.J.A.

OSMUNDA REGALIS L.—Patung Hsien; grassy spots, ravines, etc., 1000–5000 ft.; May 1907; no. 2676.—H.J.E.A.

LYCOPODIUM CLAVATUM L.—Patung Hsien; grassy spots, 5000–6000 ft.; July 1907; no. 2656.—H.J.E.A.

LYCOPODIUM OBSCURUM L.—Fang Hsien; rocks in silver fir forests, 9500 ft.; May 16, 1907; no. 2650.—J.A.

SELAGINELLA CAULESCENS Spring.—Ichang; glen, 1–1000 ft.; May 1907; no. 2654.—H.J.

Province of Szech'uan

HYMENOPHYLLUM BLUMEANUM Spreng.—Mupin; wet rocks, woodland, 4000–6000 ft., August 1908; no. 2681.—H.

WOODSIA DELAVAYI Christ.—Northeast of Ta-tsien-lu; 7200 ft.; July 2, 1908; no. 2616.

Dryopteris crenata (*Polypodium* Forskal.) O. Ktze.—Mupin; cliffs, 4000–6000 ft.; August 1908; no. 2631.—H.

Dryopteris marginata (*Aspidium* Wallich Cat. 391).—Mupin; woodland, 4000–6000 ft.; August 1908; nos. 2604, 2632.—H.

*Dryopteris pseudocuspidata Christ, n. sp.—Mupin; woodland, 6000 ft.; August 1908; no. 2603.

Dryopteris decursive-pinnata (*Polypodium* Van Hall) O. Ktze.—Mupin; woodland, 4000–6000 ft.; August 1908; no. 2618.—J.

Polystichum Prescottianum (*Aspidium* Wallich) Moore.—Ta-tsien-lu; woods, 6000 ft.; June 1908; no. 2622.—H.

*Polystichum mupinense (*Aspidium* Franchet) Bedd.—Mupin; rocks in woods, 4000–6000 ft.; August 1908; no. 2617.

*Polystichum otophorum (*Aspidium* Franchet) Bedd.—Mupin; cliffs, 5000–6000 ft.; August 1908; nos. 2598, 2624.

*Polystichum Wilsoni Christ, n. sp.—Mupin; woodland, 4000–6000 ft.; August 1908; no. 2614.

*Polystichum woodsioides Christ, n. sp.—Mupin; woodland, 4000–6000 ft.; August 1908; no. 2615.

*Polystichum lacerum Christ, n. sp.—Mupin; rocks, 4000–6000 ft.; August 1908; no. 2608.

*Polystichum leucochlamys Christ, n. sp.—Mupin; rocks, 4000–6000 ft.; August 1908; no. 2606.

Polystichum stenophyllum Christ.—Mupin; cliffs, 4000–6000 ft.; August 1908; no. 2618.

Polystichum Thomsoni (*Aspidium* Hook. fil.) Bedd.—Mupin; woodland, 4000–6000 ft.; August 1908; no. 2607.—H.

Polystichum carvifolium (*Aspidium* Ktze.) C. Chr. Ind.—Mupin; woodland, 4000–6000 ft.; August 1908; no. 2605.—H.J.

Sorolepidium glaciale (*Polystichum* Christ) Christ, n. gen.—Mupin; cliffs, 5000 ft.; August 1908; no. 2613.

Cyrtomium lonchitoides Christ.—Mupin; cliffs, 5000–6000 ft.; August 1908; nos. 2621, 2623.

Davallia athamantica Christ.—Mupin; cliffs, 4000–6000 ft.; August 1908; No. 2666.

LINDSAYA CULTRATA Sw.—Mupin; cliffs, 4000–6000 ft.; August 1908; no. 2671.

ATHYRIUM NIGRIPES Blume.—Mupin; rocks, 4000–6000 ft.; August 1908; no. 2660.—H.J.

ATHYRIUM PYCNOSORUM Christ.—Mupin; 4000–6000 ft.; August 1908; no. 2656.—J.

*ATHYRIUM MUPINENSE Christ, n. sp.—Mupin; woodland, 4000–6000 ft.; August 1908; no. 2610.

ASPLENIUM PRAEMORSUM Sw.—Mupin; cliffs, 4000–6000 ft.; August 1908; no. 2662.—H.A.

ASPLENIUM YUNNANENSE Franchet.—Mupin; cliffs, 4000–6000 ft.; August 1908; no. 2658

BLECHNUM EBURNEUM Christ.—Mupin; wet rocks, 3000–5500 ft.; August 1908; no. 2678.

GYMNOPTERIS VESTITA (*Grammitis* Wallich).—Northeast of Ta-tsien-lu; dry banks, 7000 ft.; February 7, 1908; no. 2668.—H.

*GYMNOPTERIS SARGENTII Christ, n. sp.—Monkong Ting; loamy places, warm valleys, 7000–9000 ft.; June 28, 1908; no. 2669.

PELLAEA NITIDULA (*Pteris* Wallich) Baker.—Northeast of Ta-tsien-lu; dry rocks, 6900–8000 ft.; June 30, 1908; no. 2664.—H.

DORYOPTERIS DUCLOUXII Christ.—Mupin; loamy banks, old walls, etc., 3000–5000 ft.; August 1908; no. 2667.

ADIANTUM PEDATUM L.—Mupin; woodland, 4000–6000 ft.; August 1908; no. 2673.—H.J.A.

ADIANTUM VENUSTUM Don.—Mupin; rocks in wood, 4000–5000 ft.; August 1908; no. 2675.—H.

PLAGIOGYRIA ADNATA (*Lomaria* Blume) Bedd.—Hung Yah Hsien; 3000 ft.; September 8, 1908; no. 2680.—H.J.

VITTARIA SUBEROSA Christ.—Wa-shan; on trees and rocks, 5000–7000 ft.; September 1908; no. 2638.

POLYPODIUM SUBAMOENUM Clarke.—Mupin; rocks, 3000–6000 ft.; August 1908; no. 2648.—H.

*POLYPODIUM TALIENSE Christ.—Mupin; rocks, 3000–6000 ft.; August 1908; no. 2649.

POLYPODIUM ANNUIFRONS Makino.—Ta-tsien-lu; rocks in wood, 6000–8000 ft.; June 1908; no. 2637.—J.

POLYPODIUM ENGLERI Luerss.—Mupin; cliffs, 4000–7000 ft.; August 1908; no. 2639.—J.

POLYPODIUM SHENSIENSE Christ.—Mupin; cliffs, 4000–6000 ft.; August 1908; no. 2644.

POLYPODIUM LEHMANNI Metten.—Mupin; woodland, 4000–6000 ft.; August 1908; no. 2643.—H.

POLYPODIUM GRIFFITHIANUM Hook.—Mupin; 4000–6000 ft.; August 1908; no. 2645.—H.

POLYPODIUM LINEARE Thunbg.—Ta-tsien-lu; on trees, 4000–8000 ft.; June 1908; no. 2633; on rocks, no. 2634.—H.J.

LYCOPODIUM LUCIDULUM Michaux.—Northeast of Ta-tsien-lu; rocks, 8000–10,000 ft.; June 1908; no. 2651.—H.A.

Diagnoses of the new species

Sorolepidium H. Christ, genus novum.—Habitu *Ceterach*, characteribus potius *Polystichum* referens, differt soris magnis medialibus in nervulo basali anteriore nervorum lateralium terminalibus, subrotundis, indusio proprio deficiente, indusio spurio squamis singulis vel duabus aut tribus subulatis et fimbriatis e basi receptaculi oriundis constituto.

This beautiful plant, which much resembles a xerophilous alpine Tibetan species, deserves as well as *Plecosorus* to be separated from *Polystichum* by the characters indicated above. The indusial scales are found at the base of the receptacle and are inserted on the vein, arising at the base of the pedicels of the sporangia. There is always one larger scale, and sometimes one or two smaller ones; and also always a very large one inserted on the costa of the pinna and covering the sorus. FRANCHET has placed this plant with *Gymnogramme* in the Paris Herbarium, without naming it, probably because of the confluent sori without indusia; but the sorus does not follow the soriferous vein longitudinally as in *Gymnogramme*, it is attached to a terminal receptacle.

Sorolepidium glaciale (*Polystichum* Christ Foug. de la Chine Mus. Hist. Nat. Paris, Bull. Soc. Bot. France IV. 5:28), *fig. 1.*

HAB.—Seems widely distributed in the high ranges of western China.

Discovered by Abbé DELAVAY in Yunnan on rocky declivities at the foot of the Lu Kiang glacier, July 9, 1884, n. 45. Herb. Paris. Rediscovered by WILSON in the western part of Szech'uan, 1903–1904, no. 537 (Herb. James Veitch & Sons), Bull. Acad. Geog. Bot. Mans 110, 1906; by the same collector

in the same region, Mupin, cliffs 5000 ft., August 1908, no. 2613 (Herb. Harvard Univ.).

I owe to the kindness of Mademoiselle CHARLOTTE TERNETZ, Ph.D., of Basel, the drawings of the enlarged details of this plant.

Polystichum leucochlamys H. Christ, n. sp.—Rhizomate brevi, pollicis crassitie, radicoso, cum stipite rachique squamis magnis patentibus ovato-acuminatis 4 mm. longis brunneis longe fimbriato-ciliatis, in rachi sensim diminutis et angustatis, fasciculatis et laceratis tecto; foliis fasciculatis, stipite 8–12 cm. longo, viridi aut stramineo 2 mm. crasso. Lamina lanceolato-caudata, ad basin angustata, rachi debili et arcuata praedita, 30 cm. longa 4.5 cm. lata, apice nuda elongata et gemma vivipara instructa, pinnata, pinnis 30–40 utrinque, approximatis sive admodum distantibus, infimis diminutis et reflexis, caeteris patentibus lanceolato-falcatis obtusis rarius acutis, subsessilibus, 2 cm. longis, basi 0.5 cm. latis, basi inaequalibus, postice cuneatis, antice acute auriculatis, crenatis aut decumbenti-serratis, nervis valde obliquis, soris rotundis, marginalibus, uniseriatis margini anteriori insertis, indusiis maximis, 2 mm. diametro, scarioso-hyalinis, imbricatis, bullatis, albidis, diaphanis, umbilicatis, margine minu-

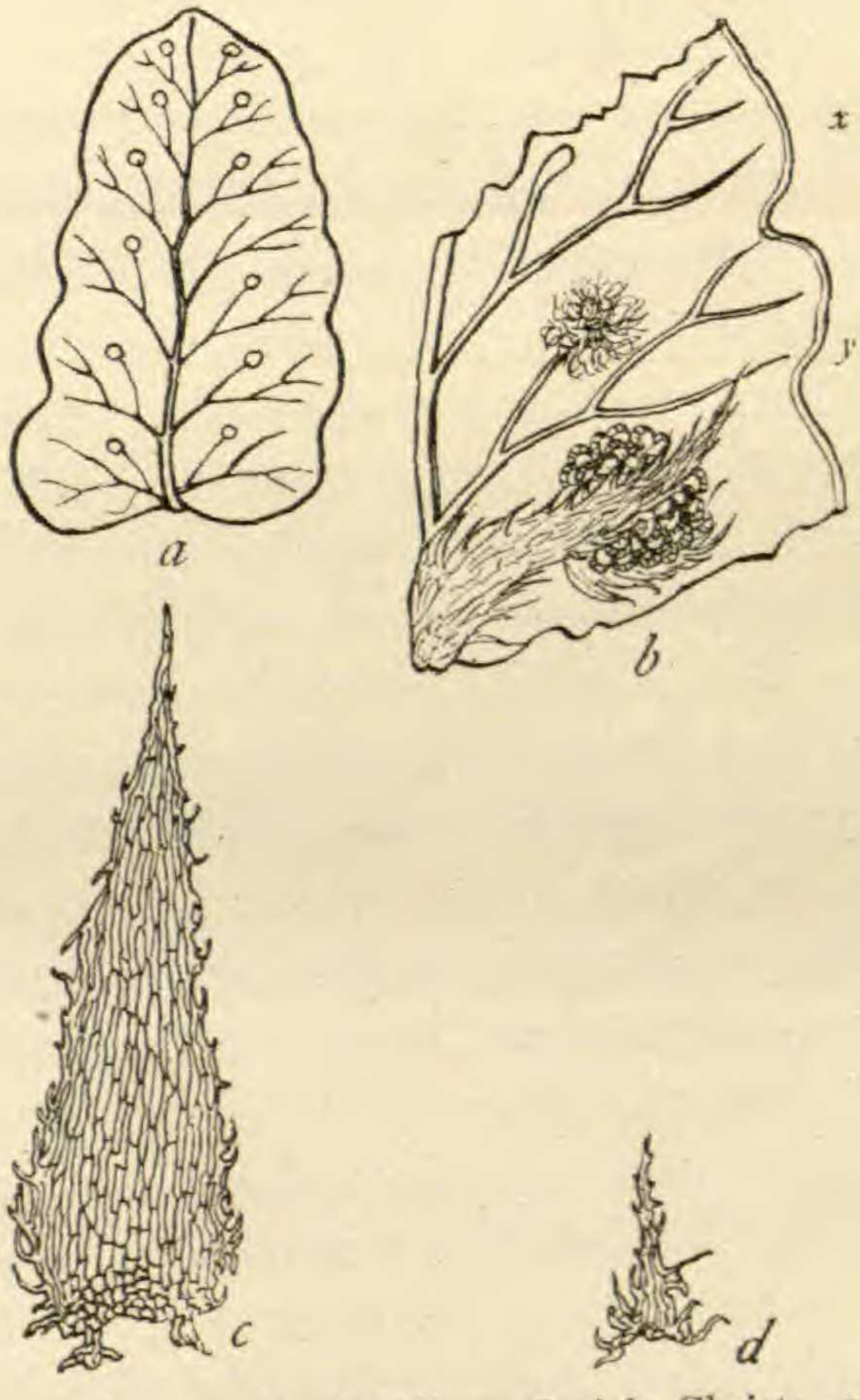


FIG. 1.—*Sorolepidium glaciale* Christ: *a*, larger pinnule, showing circular attachment of sorus (somewhat too strongly marked), ×5; *b*, portion of a pinnule (*x*, end of sorus nervule; *y*, the sporangium stalks still remaining; *z*, sorus with overlying scale from principal nerve and the under scale arising from sorus nerve), ×15; *c*, large scale, ×10; *d*, small scale, ×10.

tissime fimbriato. Faciebus hinc inde setulosis. Textura herbacea, colore dilute viridi.

Facie *P. auriculati* (L.) Prsl., characteribus *P. craspedosori.*

Highly developed form of the type of *P. craspedosorum* (*Aspidium* Maxim.) Diels; distinguished by larger dimensions, elongated stipe, and very broad swollen scarious white indusia. It is surprising to see this species from two localities so widely separated as W. Hupeh and W. Szech'uan.

HAB.—Rocky places, Mupin, W. Szech'uan, 4000–6000 ft., August 1908, no. 2606; woods and rocks, Fang Hsien, W. Hupeh, 5000–6000 ft., November 1907, no. 2600.

Polystichum lacerum H. Christ, n. sp.—Rhizomate brevi, squamis brunneis lanceolato-acuminatis 3 mm. longis fimbriato-ciliatis vestito, foliis coespitoso-fasciculatis numerosis (12) stipite brevi 3–4 cm. longo, stramineo, sed iisdem squamis setulisque cum rachi abunde tecto, lamina 12–15 cm. longa 22 cm. lata lanceolata versus apicem acuminata breviter caudata et gemma minima saepius abortiva terminata, versus basin vix angustata, pinnata, sed pinnis infimis basi profunde et fere ad costam incisis, pinnis ca. 25 utrinque patentibus, inferioribus suboppositis, sessilibus, 1 cm. longis basi 1.5 cm. latis cuneato-ovatis falcatis acutis, basi inaequalibus i.e., antice valde auriculatis, profunde lobatis, lobis ca. 5 utrinque, ovato-obtusis, rarius crenulatis. Soris magnis plerumque uniseriatis margini anteriori insertis, brunneis, sese tangentibus et subconfluentibus, indusio 0.5 mm. lato obscure griseo tenuissimo, sporangiis arctissime adhaerente margine lacerato, demum evanescente. Textura herbacea, facie superiore calva obscure viridi, inferiore hirsuta, pallidiore.

HAB.—Rocks, Mupin, 4000–6000 ft., August 1908, no. 2608.

Member of the group of *P. craspedosorum* (Maxim.) Diels, of the same habit, but with pinnae more scaly and more incised, and with the indusium more delicate and fringed.

These three species (*P. leucochlamys*, *P. craspedosorum*, and *P. lacerum*) form a distinct group of *Polystichum* (CRASPEDOSORA), characterized by marginal sori inserted at the anterior border of the pinnae, by a broad and membranaceous indusium exceeding the sorus, and by the point of the proliferous rachis. The best developed form of the group is *P. leucochlamys*, the least developed is *P. lacerum.* These two seem peculiar to western and central China, while the intermediate form, *P. craspedosorus*, extends throughout China to Japan and Corea.

Polystichum Wilsoni H. Christ, n. sp.—Rhizomate crasso obliquo radicoso atrobrunneo, squamis magnis ovato-acutis scariosis dilute brunneis margine saepe laceratis 6 mm. longis vestito, stipitibus subfasciculatis, 17 cm. longis, luteo-stramineis, 2 mm. crassis, iisdem squamis sparsis, et insuper cum rachi squamis lanceolato-linearibus et subulatis longis albidis setisque vestitis. Lamina 45 cm. longa 10 cm. lata acuminata, versus basin sensim angustata, pinnis infimis remotis valde abbreviatis et deflexis. Lamina bipinnata, pinnis ca. 35 utrinque alternis sessilibus approximatis, 5 cm. longis basi 16 mm. latis acuminatis, basi subinaequalibus i.e., pinnula basali anteriore reducta, pinnulis confertis ca. 15 utrinque, obliquis, sessilibus, oblongis acutis, inaequalibus, postice minus, antice creberrime et profunde biserrato-aristatis, dentibus angustis pectinatis, soris medialibus brunneis confluentibus, indusio inconspicuo fugaci orbiculari minuto, 0.5 mm. lato nigro-umbonato. Facie superiore pilis longissimis lucentibus parce, facie inferiore cum costa costulisque setis longis subulatis albicantibus pilisque abunde vestita. Textura herbacea, colore luteo-virente.

HAB.—Woodlands, Mupin, 4000–6000 ft., August 1908, no. 2614.

Inter *P. aculeatum* (*Polypodium* L.) Schott et *P. Bakerianum* (*Aspidium* Atkins.) Diels intermedium.

Polystichum deversum H. Christ, n. sp.—Rhizomate brevi erecto, squamis latis ovalibus acutis scariosis brunneis vestito. Stipitibus fasciculatis 4 cm. longis, iisdem squamis et minoribus laceratis vestitis, sulcatis, 1.5 mm. crassis. Lamina 33 cm. longa, 3 cm. lata acuminata, versus basin sensim angustata, lineari-lanceolata, pinnata, rachi straminea, squamis castaneis fasciculatis laceratis variegata, pinnis ca. 45 utrinque, pectinato-confertis, petiolulatis, deflexo-reversis, inaequalibus, 11 mm. longis, basi 6 mm. latis, rhombeo-trigonis, basi posteriore cuneato-abscissis, anteriore acute auriculatis subintegris aut minute crenulatis, nervis confertis ramosis subflabellatis, soris medialibus, remotis, rotundis, ca. 5 utrinque. Facie superiore subglabra, inferiore squamis acutis adpressis ochroleucis tecta, margine breviter ciliato. Textura firme papyracea, colore supra laete virente, subtus pallidiore lutescente.

HAB.—Woodlands, Fang Hsien, W. Hupeh, 5000–6000 ft., August 1907, no. 2625.

Group of *P. deltodon* (Bak.) near *P. stenophyllum* Christ, but distinguished by its larger dimensions, short stiped fronds gradually attenuated toward the base, broad triangular-rhomboidal pinnae hardly dentate and with a dense coating of appressed scales.

Polystichum woodsioides H. Christ, n. sp.—Rhizomate brevi, squamis integris ovatis brunneo-scariosis 3 mm. longis vestito, foliis fasciculato-coespitosis numerosis (10), stipite valido, obeso 1.5 mm. crasso 6 cm. longo flavo-stramineo versus basin atro-brunneo, squamis scariosis dilute brunneis ovatis acutis integris, angustioribus pilisque brevibus mixtis vestito, rachi crassa setulis pallidis pubescente, fronde 15 cm. longa, 23 mm. lata lineari-lanceolata acuminata versus basin angustata, bipinnatifida, pinnis confertis, inferioribus remotioribus et valde diminutis, ca. 27 utrinque, fere sessilibus deltoideo-oblongis, e basi latissima versus apicem obtusum attenuatis, 1 cm. longis, basi 0.5 cm. latis, profunde et ad basin ad costam incisis, segmentis ca. 5 utrinque imbricate-confertis, infimis liberis, superioribus basi connatis, ovatis acutiusculis, minute dentatis, subtus pubescentibus, supra calvis, soris in tertia frondis parte superiore positis, numerosis, 3 aut 4 pro lobo, rotundis, continguis et confluentibus, brunneis, indusio peltato corrugato persistente brunneo minuto, umbone nigro. Textura molliter herbacea, colore supra obscure, subtus pallide virente.

HAB.—Woodlands, Mupin, 4000–6000 ft., August 1908, no. 2615.

Species with very narrow fronds resembling in habit small alpine species of the group of *P. lachenense* (Hook.) Bedd., but belonging rather to the group of *P. mupinense* (Franch.), being bipinnate. Remarkable for the very small but much incised pinnae and thick rachis.

Polystichum molliculum H. Christ, n. sp.—Rhizomate brevissimo radicoso coespitoso, cum stipitis basi squamulis subulatis brevibus sparso. Stipitibus fasciculatis numerosis stramineis filiformibus 3.5 cm. longis, cum rachi raris setulis sparsis, lamina 4 cm. longa, 1 cm. lata, lanceolata obtusa bipinnatifida. Pinnis ca. 4 utrinque suboppositis, sessilibus, late obovatis basi subinaequalibus antice auctis, flabellato-incisis, inferioribus usque ad costam partitis ideoque auriculatis, lobatis, 3 ad 5 mm. longis et

latis, lobis ovato-rotundatis acutis interdum dentatis. Soris magnis, singulis in lobis, demum confluentibus, indusio inconspicuo corrugato. Textura tenuiter herbacea, colore laete virente.

HAB.—Rocks, Fang Hsien, 8000 ft., June 27, 1907, W. Hupeh, no. 2657.

An extremely reduced species, with the habit of a very small *Cystopteris*, distinguished from *P. capillipes* (Baker) Diels by the less incised pinnae with broader segments.

With the six species here described, with which Mr. Wilson has enriched the flora of China, the Chinese species of *Polystichum* now known number 52. There are few examples of so rich and continuous a development without gaps between the different known forms of this genus, so essentially Chinese. The species of *Polystichum* of other regions of the globe seem to be only derivatives or scattered offshoots of this great eastern center.

Gymnopteris Sargentii H. Christ, n. sp.—Rhizomate valido pollicis crassitie, obliquo, setis mollibus 0.5 cm. longis pallide rufis densissime obtecto, radicibus numerosis fasciculatis. Stipitibus subfasciculatis 3 aut 4, flexuosis crassis rigidis 3 mm. diametro, rufostramineis, 8 cm. longis, cum rachi aeque rigida et 2 ad 2.5 mm. crassa costisque tomento albido-fulvo omnino-vestitis, lamina late deltoideo-ovata 20 cm. longa 9 cm. lata abunde bipinnata, pinnis remotis ca. 6 utrinque infra apicem brevem simpliciter pinnatum, erecto-patentibus, infimis suboppositis coeteris alternis, basalibus haud abbreviatis, 7 cm. longis 14 mm. latis, lineari-lanceolatis breviter petiolatis, costa rigida vix 1 mm. crassa, pinnulis ca. 7 utrinque, approximatis, deltoideis obtusis basi late trilobo-hastatis 7 mm. longis 5 mm. latis petiolulatis, rigide coriaceis, supra calvis obscure viridibus, subtus et margine densissime rufotomentosis nitidis. Soris submarginalibus confluentibus.

HAB.—Loamy places in warm valleys, Monkong Ting, W. Szech'uan, 7000–9000 ft., June 28, 1908, no. 2669.

This is the most developed species of the series formed by the three species *G. vestita* (*Grammitis* Wallich) Underw., *G. bipinnata* Christ (Notul. Systemat. Mus. Paris no. 2, p. 23. 1909), and *G. Sargentii*, distinguished by its larger dimensions, and a broadly bipinnate frond with numerous trilobed pinnules. Habit nearly that of *Pellaea hastata* (Thnbg.) Prantl. *G. bipinnata* differs by the slender rachis, elongated lanceolate pinnate to nearly bipinnate fronds, and less incised pinnules.

Athyrium mupinense H. Christ, n. sp.—Rhizomate brevi erecto radicoso, cum basi stipitis setis atrobrunneis flexuosis fere

0.5 cm. longis e verruca oriundis vestito. Stipitibus fasciculatis numerosis (ca. 12) tenuibus flaccidis stramineis 5 cm. longis, lamina 20 cm. longa 5.5 cm. lata acuminata basi aliquantulum angustata lanceolato-oblongo bipinnata. Rachi tenui parce setulosa, planta caeterum calva. Pinnis 25–30 utrinque, alternis, approximatis, recte patentibus, deltoideo-ovatis acutis, petiolulatis basi inaequalibus i.e., pinnula basali anteriore aucta, 2 cm. longis basi 12 mm. latis, ad alam angustam incisis, pinnulis confertis sessilibus, infimis rarius subpetiolulatis, ca. 7 utrinque, oblongis subobtusis, basi subinaequalibus i.e., antice auctis, 1 cm. longis 3 mm. latis, acute sed breviter serratis nec aristatis, soris rotundis vix 1 mm. latis brunneis ca. 4 utrinque, medialibus, haud confluentibus, indusio fugaci reniformi. Textura flaccide herbacea, colore obscure virente.

HAB.—Woodland, Mupin, 4000–6000 ft., August 1908, no. 2610.

Affine *A. demisso* Christ in Fedde Repert. 5:284. 1908. Insularum Jezo et Quelpaert, quod differt dentibus aristato-pectinatis. Planta humilis, *A. anisoptero* Christ aut *Cystopteridi* similis.

Adiantum aristatum H. Christ, n. sp.—Rhizomate breviter repente, tenui, squamis subulatis atrobrunneis vestito. Stipite valido, erecto, tereti, atropurpureo nitido, laevi uti tota planta, 1.5 mm. crasso 120 cm. longo. Fronde late deltoideo-ovata, basi rotundata, apice acuta aut obtusa, 13 cm. longa, 9 cm. lata, tripinnata, pinnis pinnulisque imbricato-confertis, brevissime petiolatis, pinnis 6–10 atrinque curvato-ascendentibus inferioribus, deltoideo-ovatis, 8 cm. longis, pinnula basali anteriore rachi incumbente, segmentis latissime cuneato-flabellatis, antice semicircularibus, 1 cm. latis, 8 mm. longis, papyraceo-firmulis, glauco-viridibus, antice profunde et creberrime aristato-serratis, dentibus deltoideis, dentibus usque ad ca. 24 numero. Nervis confertis flabellatis. Soris numerosis sed medio in margine segmenti solitariis rarissime binis i.e., partitis, usque ad 2 mm. longis 1.5 mm. latis, leviter curvatis nec sinu inclusis, indusio ochraceo firmo laevi.

HAB.—Rocks, W. Hupeh, Fang Hsien, 3000–4000 ft., November 1907, no. 2674.

Of the group of *A. venustum* Don, which is essentially Chinese (DIELS Fl. Central China 5:201. 1901), and which embraces half a score of species

related but perfectly distinct; two species extend beyond China, *A. venustum* of northern India and *A. monochlamys* Eaton of Japan. Our species is nearest to *A. Davidi* Franch., but differs in its larger dimensions, more rounded, monosorous pinnules, with numerous and aristate teeth.

Dryopteris pseudocuspidata H. Christ, n. sp.—Rhizomate repente, fere digiti minoris crassitie, brunneo, sublaevi, radicoso, stipite subsolitario, anguloso, 55 cm. longo, sublucido, dilute brunneo, pennae cygni crassitie, versus basin squamis ovatis obtusis brunneis deciduis sparso, planta caeterum laevi. Fronde 36 cm. longa 22 cm. lata, basi haud angustata, late ovato-deltoidea, acuminata, pinnata, pinnis ca. 18 utrinque, patentibus, 12 cm. longis 1.5 cm. latis lanceolato-acuminatis, vix petiolulatis, basi rotundato-truncatis, superioribus sensim diminutis nec adnatis, suprema petiolata valde diminuta. Pinnis dentatis, dentibus decumbentibus acutis interdum serrulatis. Costa manifesta prominente. Nervis ca. 40 utrinque, patentibus. Nervulis plerumque 6 utrinque, omnibus arcu acuto junctis. Soris minutis 6 utrinque medialibus brunneis, rotundis, separatis, exindusiatis. Textura papyracea, colore opaco, obscure viridi.

HAB.—W. Szech'uan, woodland, Mupin, 6000 ft., August 1908, no. 2603.

Habit of *D. cuspidata* (*Aspidium* Metten.) syn. *D. khasiana* C. Chr. Ind. 272, but belonging to the group *Nephrodium* with six lateral united veinlets.

PTERIS CRETICA L. var. **subserrulata** H. Christ, n. var.—A typo differt foliis papyraceis nec subcoriaceis dimorphis, fertilibus valde angustatis, sterilibus magis compositis, pinnis inferioribus basi bi- aut tripartitis, pinnulis lateralibus abbreviatis, rachi superiore late alata, marginibus acute et grosse biserratis.

HAB.—Shady rocks, Fang Hsien, 3000–5000 ft., July 1907, no. 2670.

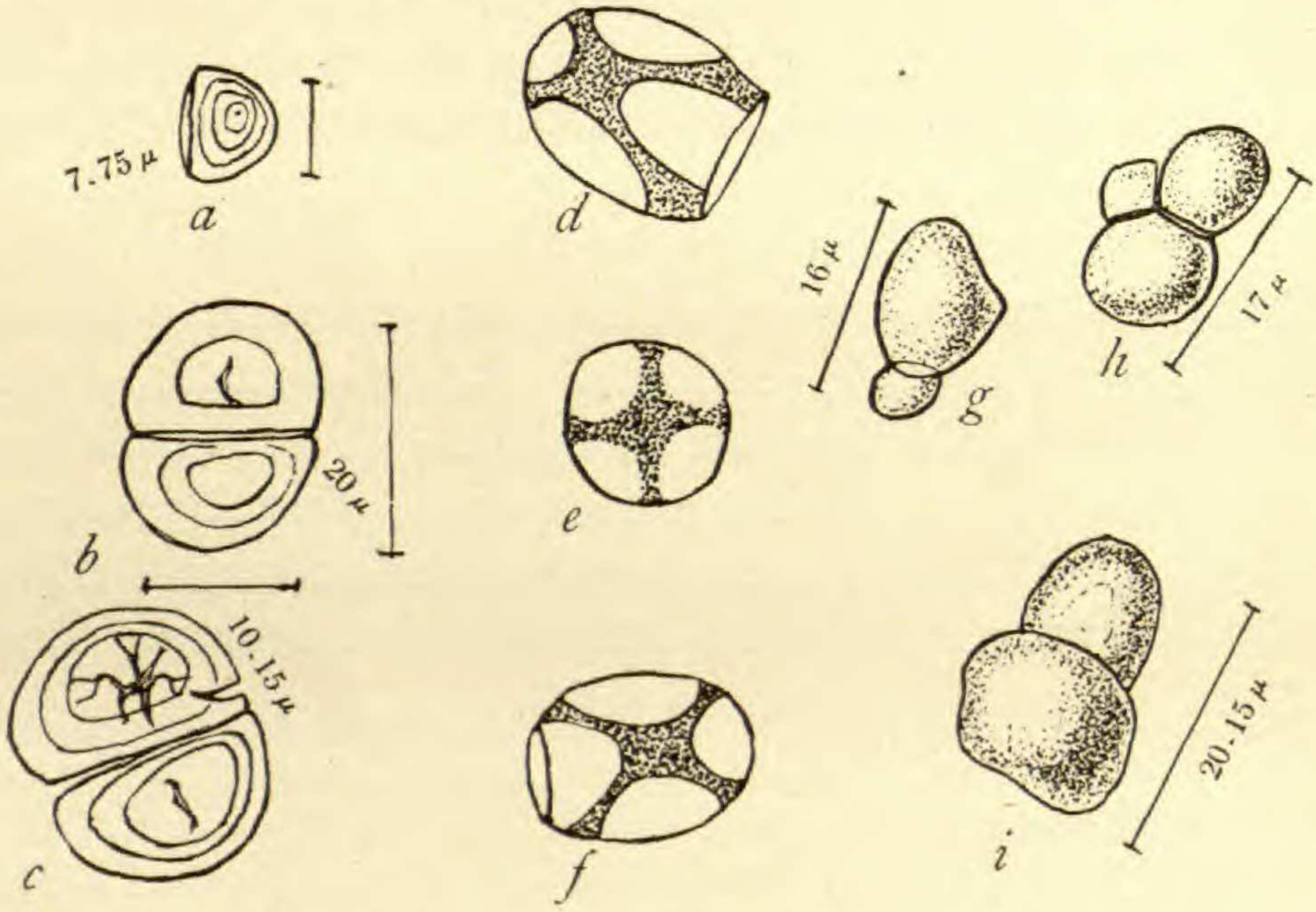
In China *P. cretica* varies much and approaches *P. serrulata* L. fil. There are also forms of the latter species that approach *P. cretica* (Filic. Shen-si septentr. a P. J. GIRALDI lectae in Nuov. Giorn. Bot. Ital. IV. 1:6. 1897; *Pteris serrulata* var. *intermedia* Chr.), so that it is sometimes difficult to maintain a difference between the two species.

The starch of *Pteridium aquilinum* (L. Kuhn)

The specimen of starch from the rhizome of *Pteridium* from Ichang, below the famous gorge of the upper Yang-tze, Province Hupeh, that Mr. E. H. WILSON sent to Harvard University, con-

sists of compact angular fragments 1 cm. or more square, very white and pure, derived evidently from a layer precipitated in water. Professor SENN of Basel has kindly examined the specimen and I owe to him the accompanying drawings and the following description:

"The starch in question consists for the most part of combined grains. The grains joined in pairs have one side parabolically



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FIG. 2.—Starch of *Pteridium aquilinum:* explanation in text

rounded, while the side in contact is plane (fig. 2, *a–c*). Where there are several parts combined, they are placed sometimes one behind the other, sometimes one beside the other (fig. 2, *h*). The diameter of the grains vary from 3 to 18 μ; the average diameter is between 6.5 and 3 μ. The structure is slightly eccentric, depending on the arrangement by layers, which are not very evident except by examination with polarized light. The dark cross obtained by crossed Nicols is near the rounded end, and is seen especially in grains somewhat elongated (fig. 2, *d* and *f*). By a greater enlargement the nucleus of the layers can be observed (fig. 2, *a*). In the nearly globular grains the two dark striae cross in the middle (fig. 2, *e*). When the grains are submerged in water and under pressure of the cover glass, irregular cracks are seen,

which start often from the nucleus (fig. 2, *b* and *c*). The cause of these cracks is not the swelling but the pressure. In warm water the grains swell without cracks, and take the form of irregular linguiform corpuscles."

It is well known that the rhizomes of *Pteridium* have served on a large scale and still serve as food because of their richness in starch. In New Zealand and Australia they have been much used, and the natives of the Canary Islands make use of them also (C. Bolle, Standorte der Farne auf den Canarischen Inseln, Zeitschrift für Allg. Erdkunde, Neue Folge xiv. 304). In 1884 I myself saw a peasant on the slope of Pic de Teneriffe dig up these rhizomes for this purpose. It is in the roasted and ground state that this root is used as food. According to Hooker (Spec. Fil. ii. 199), Dr. B. Clarke has written an article (Hook. Jour. Bot. 9:212) recommending the use of this food. But the extraction of starch as the Chinese of Ichang practice it seems to be very rare. I find, however, a citation of Labillardière which says: "Amylacea radicum substantia, quam eliciunt mandendo, silvicolae Cap. V. Diemen sustentantur" (Agardh Recens. spec. gen. Pteridis 1839, p. 46).

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